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OF THE
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MORRIS ARBORETUM
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THE
MORRIS ARBORETUM
OF THE
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View at the Swan Pond

The illustration appearing in this number is a view at the Swan Pond, through which the East Brook flows.

On the left side of the picture are branches of the Japanese varnish tree *(Koelreuteria paniculata)*, and, seen through it, the top of a Japanese black pine *(Pinus thunbergiana)*. Rhododendrons appear at the water's edge.

The low growth on the island in the middle of the picture is made up of laurel and rhododendron. Above these spread the tops of a dogwood and a sorrel-tree *(Oxydendron arboreum)*.

On the right of the stream are the large leaves of the umbrella tree *(Magnolia tripetala)* and the top of a European larch *(Larix decidua)*.

In the middle background is seen the spreading top of a weeping willow.

RODNEY H. TRUE.

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WINTER INJURY TO CONIFERS AT THE MORRIS ARBORETUM

A COLLECTION of uncommon conifers that had grown so well for many years at the Arboretum prior to the devastating winter of 1933-34 present interesting data, which should prove of some value in the future. As concrete examples of this use of information, gained by the wholesale killing of Boxwood during sub-zero temperatures, and the proven hardiness of the Taxus to withstand the same conditions, nurserymen have already substituted Taxus plantings for those of Boxwood.

It has been a common practice in Philadelphia and the adjoining territory, especially during the long period of mild winters, to plant such species of conifers as are of questionable hardiness and which border between hardy and semi-hardy in this vicinity. These plants have grown well and have been greatly appreciated by the growers, but it has been necessary to afford them winter protection in the form of corn fodder, boxes or similar materials. While it is mainly a matter of personal preference among the growers, it is the opinion of the writer that boxes or materials which permit free circulation of air throughout the plant have a tendency to eliminate injury caused by low temperatures or scalding from over-heating during warm, sunny spells.

During the winter in question, a four-foot plant of the Long Leaf Pine—*Pinus palustris*—which had been obtained from the South and planted the previous spring, withstood the rigors of the extreme cold with the protection of a wooden box, free from interior packing of any kind and lidless, to insure free circulation of air.

The most important factor in the elimination of winter injury due to low temperatures is to supply the proper environment in which the plant is to grow. While some may withstand low, moist positions, conifers as a rule prefer higher elevations, where a free circulation of air is assured, and a well-drained soil of acid reaction. This does not apply to species of Juniper and other swamp-loving forms. For the above reason it may be possible that some of the rare conifers killed during this winter were killed because of low elevation instead of cold. Under different environmental conditions, the injury may have been lessened or eliminated entirely in some species. Under these severe conditions, we have learned from observation that such species as the Atlas Cedars, which were not considered as hardy as they proved to be, can and did withstand the sub-zero temperatures. They have now withstood two such severe winters successfully.

The percentage of injury recorded in the following list of plants is based on the excessive and not the average burning or discoloration of foliage during the average winter injuries. An unofficial temperature of 17° below zero was recorded at the Arboretum. Although this may not be correct, it will serve as a basis for recording the approximate temperature the following species were subjected to.

The following species were well established plants, growing on low, moist ground in an open position, exposed to the west and southwest, and protected from

the north and east by tall windbreaks of oak and maple trees. The specimens had been given a protective covering of corn fodder before the extreme cold weather set in, and sufficient water to the root system.

Cedrus deodara, Laws, M489

A healthy, vigorous, growing specimen, 12 feet to 13 feet high, was entirely killed by early spring.

Cedrus deadora, Laws, M397

Growing quite near the above, the same size, age, and healthy condition, and having the same protection. The foliage remained green during the spring and until early summer, at which time the entire plant died. The stumps were allowed to remain until August, but no sign of recovery was indicated.

Cedrus libanotica, Link, M495

Cedar of Lebanon. A strong, healthy specimen, completely killed by spring.

Cedrus libanotica, Link, M493

Same condition and size as the above, 60% of the foliage remained green until July, when the plant died.

Cedrus libanotica, Link, M398

Much larger and older tree than the two preceding specimens, but growing under the same conditions. No visible injurious effects were observed in the spring and summer, nor did any develop at a later date. This plant is still living after two such winters.

Cryptomeria japonica, D. Don., M368

Foliage 100% killed in the spring. The branches were pruned back and the tree allowed to remain for signs of recovery, but none occurred.

Cryptomeria japonica Lobbii, Carr., M488

Entire plant 100% killed by spring.

Cryptomeria japonica Lobbii, Carr., M499

One small growth, having live, green foliage, remained until early summer. Entire plant destroyed.

Cryptomeria japonica Lobbii, Carr., M1054

Much larger and older specimen growing among a group of conifers in a protected area, having the upper part of the tree exposed to sun and wind, and on slightly higher ground; 30% of branches and foliage was destroyed. There was a slight recovery and the plant is still living.

Cunninghamia lanceolata, Hook. M383

A Chinese species considered less hardy than many of the foregoing specimens. An exceedingly strong, vigorous plant, 5 to 6 feet high and well covered with corn

fodder. When uncovered this was found to be completely killed, but one-year-old cuttings from this specimen, growing in a cold frame on high ground, with slight protection and being exposed to the south and southwest, did not receive the slightest injury.

Libocedrus decurrens, Torr., M497

"Incense Cedar." Strong, healthy plant—was 100% killed by spring.

Libocedrus decurrens, Torr., M498

Same size, shape and healthy condition, and growing under exactly the same conditions as the above—received a slight foliage burn only on west side of tree, but entire plant died some months later.

Sequoia gigantea, Decne., M384, M385 and M386

Specimens of the Giant Sequoia, 5 to 6 feet tall. With the exception of slight tip injury, these were healthy plants, and well covered. They were completely killed, but 12 seedlings of the same species, 12 inches and 18 inches tall, growing on high ground in slightly protected cold frame, did not show winter injury other than discoloration of foliage.

Cephalotaxus drupacea, Sieb. & Zucc., M473

Strong, healthy and bushy plant, growing on higher ground, away from the flat, open space of the preceding species on protected hillside having a south and southeast exposure. Vegetative growth 80% killed. During the following summer a few new growths developed on the old stems, but did not mature. The specimen eventually died at the base, from which a new top has developed.

Cephalotaxus drupacea, Sieb. & Zucc., M59

Growing a few feet from the above and in the same healthy condition; same size and age. Entire growth killed to ground. After pruning, strong healthy branches developed from base of stump during summer. The following year this plant died from sub-zero temperatures.

Cephalotaxus Fortunei, Hook, M60

Strong, healthy plant, growing under exactly the same conditions and exposure as the above. Received 90% growth kill. During the summer a few weak growths developed from the base, but did not mature.

The following species of the Atlas Cedars, the beauty and size of which are so much appreciated at the Arboretum, received no permanent damage from the severe low temperatures. Growing on a sunny hillside and protected from the north and northwest, and provided with good drainage, the usual browning of the foliage was slightly more pronounced, especially of the variety glauca. It is gratifying to report the degree of hardiness these valuable species exhibited, especially since they have been considered so much more tender. It has been suggested that the fact that the seed supply from which these trees were grown was gathered at a high elevation in the Atlas Mountains is responsible for their hardiness. This undoubtedly is a con-

tributing factor, but the selection of the site evidently supplied the proper environment for them. This collection includes: Cedrus atlantica, Manetti, M303; Cedrus atlantica aurea, M864, Cedrus atlantica argentea, Murr., M858 and Cedrus atlantica glauca, Carr., M1116.

Taxus baccata fastigiata, Loud., M54

The Irish Yew, growing on a slight grade and protected from the north and northwest by a steep hillside and other tall vegetation, but exposed to the south. Healthy, large specimen received 70% killing of the branch ends. Recovery during the following summer nominal, and, due to internal structure injury, the plant died later.

Taxus baccata fastigiata, Loud., M140

Same size and age as the above. Did not exhibit any external injurious effects, but was seriously affected by internal injury later and eventually died.

Taxus canadensis aurea, Hart, M1209

Received 80% injury to individual growths. Two growths, each 6 feet high, did not show the slightest injury, and remained green the whole summer. A few weak growths developed, but no permanent recovery resulted.

With the exception of the two preceding species, it has been observed in the Arboretum that all other species and varieties of Taxus were unaffected by the severe winter conditions.

Other conifers growing in the Arboretum, which were uninjured by the severe climatic conditions of 1933-34, are represented by the Cedars, Cypress, Firs, Junipers, Larches, Pines (with two exceptions), Hemlocks and Spruces.

JAMES LAMBERT.

CONSERVATION OF TREES

PEOPLE WHO LIVE in cities sometimes have a hard time keeping in touch with Nature. They must leave home or go to the limited areas preserved as parks. An attempt to maintain a slender connection is seen in the trees planted along the streets.

I want to speak a word for those trees. They have a hard time of it, tough citizens though they must necessarily be. Their root systems are forced to grow under water-tight roofs of asphalt and concrete, and are forced into the presence of sewers, gas pipes, and other underground features that can give little help and occasionally much harm. Above ground, they are obliged to live in an atmosphere more or less man-tainted with coal smoke, industrial gases and particles of carbon that tend to block up the pores of their leaves, through which carbon dioxide escapes and oxygen enters. Sometimes, the insult becomes too much to bear and they languish and die.

The delivery horse, while waiting for the driver to leave his bottle of milk or loaf of bread, used to relieve the tedium by gnawing the bark of the street tree. The careless driver of the coal wagon still breaks or damages the lower branches of trees and lets fungi into the wounds, from which starting points the rest of the tree is invaded. As trees grow old, and larger, their bases push out nearer to the curb and are often damaged by the hubs of wagons and cars that knock off areas of bark. These areas, again, let in fungi that bring delayed destruction.

Sometimes, trees suffer because of well-meant efforts of friends. Heavy iron tree guards are sometimes set up around trees to protect them from the horse and other danger. In time the tree fills the guard, and unless the friend relaxes the pressure by opening it or by removing it, the guard cuts into the tree, sometimes quite or almost ringing it.

But, the danger is not over if the roots do find a source of water and minerals down under the street and sidewalk. Even if no horse gnaws off a patch of bark and no wind tears off branches, even though the coal cart has been mindful and the trees make a fine, rapidly-growing top, as they become taller another danger threatens them, and the better the growth, the greater is the danger. Some morning in late spring or summer, a gang of tree pruners comes into the street armed with saws and shears, and proceeds to cut the top off or take out part of it, leaving it a caricature of a tree, a misshapen, mangled thing, whose only offense was that it was in danger of reaching the wires. The street, after such a visitation, is a sad sight. The truck following the gang is full of tops and branches of trees that did too well. They are left with their untreated wounds inviting fungi to come, and after years of delay complete the ruin. It may not be known that an owner of trees has a right to forbid such operations.

So, we inconsistent humans, obeying a sane impulse to have shade and coolness and a bit of natural beauty, plant trees in cities. The trees struggle more or less successfully with bad root conditions and with man-made atmospheres, only in the end in many streets to suffer mangling from hasty gangs, who must keep the wires clear by the least troublesome and least expensive means. All cities do not do things this way, but one not far away does.

The city, having streets shaded in the summer by healthy trees, bordered in the fall with the gold and crimson of autumn, and beautiful in the winter with the stark but marvelous architecture of stems and bare branches, is a better place for us humans to live in than one lacking these things.

RODNEY H. TRUE.

(Delivered Wednesday, October 16, 1935, over Station WFIL—Strawbridge & Clothier Store—for the Council for Preservation of Natural Beauty in Pennsylvania.)

LATE WINTER BIRDS OF THE ARBORETUM

THAT curious and seldom observed bird, the Brown Creeper, *Certhia familiaris americana,* is most beneficial to such a place as the Arboretum or any locality where trees grow. It spends almost its entire existence minutely examining the crevices in the bark of the trunks and large limbs of trees in a never tiring search for insects, their eggs and larvæ. Starting at the base of a tree this bird ascends spirally until it reaches the first limbs where it may go a short distance along one but more commonly quickly dives in a gliding fashion to the base of an adjoining tree, there to repeat the performance. All year round this food is found in one form or another, and the diet is occasionally varied with pine seeds and the like.

Small and slim in appearance when compared with the English Sparrow, it is not usually seen by the casual person as its color pattern is protective and blends exceedingly well with bark. The upperparts are medium brown streaked with whitish and darker brown while the underparts are grayish-white and the seasonal and sexual differences in plumage are slight. This species is almost perfectly adapted to its environment and manner of living, not only by coloration but also structurally. The bill is slender, sharp and curved, all of which makes an excellent tool for probing and extracting; the claws are long, sharply pointed and well curved, producing extraordinary adeptness for clinging to and hitching up both rough and smooth types of bark; the tail feathers are rigid and pointed, serving as a prop in the bird's ascent and food searching much in the fashion of the woodpeckers. Its call note is thin, fine and lisping and quite inaudible to many people; in fact, those who are capable of hearing it must listen well to distinguish the sound.

The family of Creepers is represented in North America by only one species, which is divided into five subspecies, the Brown Creeper being the form found in this section of the country. It breeds in the Canadian and Transition Life Zones from southern Manitoba east to southern Quebec, south to Nebraska, Indiana, New York and along the Alleghanies to North Carolina. In winter it is to be found over a great part of its breeding range and south to Texas, Alabama and Florida. The nest is unique, as it is placed on the side of a dead or dying tree behind a piece of loose bark, and is composed of bark fibers, small twigs, moss, bits of wood and spider webs. Varying from five to eight in number, the eggs are white spotted and speckled with reddish-brown chiefly in a wreath around the larger end.

Though not present in this district during the Summer months, this bird is quite common throughout the duration of both the Spring and Fall migrations. In Winter it may be observed singly and in pairs wherever there are trees, and some years it is common at this time. Accordingly, the insects are destroyed in great numbers, as they are much in evidence at these periods in the form of either adults, larvæ or eggs. Through the colder months insects in the various stages of life are concealed in the crevices of bark, hence the diligent search made for them by the Brown Creeper. As far as known, the insects eaten are mostly those which are injurious to plant life and therefore this species is a very valuable assistant to the horticulturist and forester.

While endeavoring to find a mate, its delicate, pure and warblerlike song may be heard. During the Winter it is to be found in the company of Downy Wood-

peckers, Kinglets, Chickadees, and Nuthatches. Under most conditions it is a comparatively tame bird and ignores an observer unless a very close approach is attempted. Its tenacity has been proven by the fact that individuals have been discovered frozen to death with the small bodies still clinging to the bark.

Mallards have been seen again, whose wariness strongly suggested they were wild birds. A flock of Cedar Waxwings remained on the berry-bearing tree No. 305 until all of the fruit was consumed. The tree in question is on the highland by Hillcrest Avenue, *Phellodendron,* the Cork Tree, No. 969, is being visited by a great number of Robins, which are feeding on the berries which it bears. This tree is one of the group just to the north of the main building. Purple Finches were found eating the berries on the native Holly and also the buds on the trees to the rear of of the boathouse.

The following species were added to the list during the period from the middle of December, 1935, to the eighth of March, 1936.

Great Blue Heron—Ardea herodias herodias

One seen along the mill creek on the farm.

Sharp-shinned Hawk—Accipiter velox velox

One seen diving into a flock of small birds in the orchard. The chase was unsuccessful.

Killdeer—Oxyechus vociferus vociferus

This species was found in numbers on the low wet places about the farm.

Northern Flicker—Colaptes auratus luteus

One located near the main building. Will undoubtedly be common in a short time.

Eastern Robin—Turdus migratorius migratorius

Coming through in large flocks and from now on will be common.

Eastern Golden-crowned Kinglet—Regulus satrapa satrapa

Only one seen, which was rather surprising.

Eastern Meadowlark—Sturnella magna magna

One seen and heard singing in a tree on the farm meadow, where many should shortly be in evidence.

Purple Grackle—Quiscalus quiscula quiscula

Now coming through and roosting in large flocks. A number will no doubt breed.

Eastern Purple Finch—Carpodacus purpureus purpureus

Six appeared in pairs, all in Compton.

Eastern Field Sparrow—Spizella pusilla pusilla

One observed in tree by duck pond. Should be common in a short time.

LEWIS MACCUEN SMITH.

DISEASES OF THE HIMALAYAN PINE

ABSTRACT OF LECTURE BY

PROFESSOR HARLAN H. YORK

DELIVERED AT THE MORRIS ARBORETUM—FEBRUARY 8, 1936

INJURIES resulting from low temperature are of common occurrence among woody plants when the right conditions prevail. Some of the conditions which predispose to injury are: Uncongenial environmental factors, such as drought, lack of necessary food materials, and improper aeration of the soil. Thus, what may appear to constitute winter injury may be only a secondary effect; hence, it may often be exceedingly difficult to diagnose so-called "winter injury."

Injuries from low temperatures, even though slight, may often become places for the entrance of parasitic fungi into the plant. As a matter of fact, any sort of injury in the outer covering of a tree constitutes an avenue of infection for various parasites.

The winter of 1933-34 was extremely severe on our woody ornamental plants, especially those of foreign origin. Conspicuous among these was the Himalayan pine, *Pinus excelsa,* one of the most beautiful pines in the world. It had seemed to show splendid adaptability to various types of soil around Philadelphia, Baltimore, Washington, and other cities. Hundreds of these trees have died. Many inquiries have been received about this disturbance and what steps should be taken to save the remaining trees.

It seems to be common belief that the loss of the Himalayan pine is due primarily to winter injury. In his investigations on the Himalayan pine disease in Chestnut Hill and other suburban sections around Philadelphia, the speaker has found comparatively few trees which appeared to have been killed outright by the extreme cold. It was evident in the vast majority of cases that some factor other than "winter injury" was directly responsible for the death of the tree and for certain diseased conditions of trees yet living. A brief summary of some of the results of the speaker's investigations shows that young trees which were apparently in a vigorous, thrifty condition were not injured, or only slightly so. The finer roots, especially the mycorrhizal, or "feeding roots," of the injured trees were dead, or in a very poor condition. The soil around these trees was very compact, a condition highly unfavorable to aeration, and was low in essential nutrient materials. The rainfall during the latter half of the summer and fall of 1933 was so scant that the ground became quite dry to a depth of several inches. Severe winter injury is often preceded by such summer conditions.

Winter injury, as observed in the Himalayan pines, usually resulted in the killing or weakening of the tissues of the inner bark of the tree. These injuries were often more or less localized as patches of varying areas. Injuries of this sort in many cases were more common on the south to the southwest side of the tree. Winter injuries of this type are really wounds, which are readily entered by various organ-

isms, especially parasitic fungi, which may invade and kill the uninjured tissues of the inner bark, ultimately causing the tree to die.

Mr. John A. Jump, graduate student at the University of Pennsylvania, in his investigations at the Morris Arboretum, is finding that some of these parasitic fungi may attack other exotic pines, which apparently have not been winter-injured.

Among the various fungi which have been isolated from lesions caused by frosts and winter injury is one which seems in many cases to become parasitic in the inner living bark. This organism has been identified as *Sphaeropsis malorum*. In its form it shows a striking resemblance to a fungus which is parasitic on the leaves and stems of the apple tree. The *Sphaeropsis*, which attacks the Himalayan Pine, was isolated from trunk cankers on *Pinus monophylla* and from lesions on large branches of *Pinus cembra* and *Cryptomeria japonica* in the spring of 1933. It was also found on the main stem of a Himalayan pine and a branch canker of the Austrian pine in the fall of 1933.

Mr. Jump inoculated one-year-old seedling Himalayan pines in the greenhouse at the University of Pennsylvania with *Sphaeropsis malorum*, which he isolated from the diseased bark of a large Himalayan pine at the Morris Arboretum, and which was severely injured by freezing in the winter of 1933-34. He has found that this fungus is capable of living in the outer dead tissues covering the stems and producing its fruiting bodies. Apparently, the inoculated seedling Himalayan pine trees so far have not been injured.

From these experiments and various investigations, it seems that *Sphaeropsis malorum* may live in the outer dead bark of various conifers, lurking around, so to speak, biding its time until the living tissues of the bark are injured or weakened, and then invading with deadly effect.

In conclusion, it appears that if we knew how to maintain a congenial environment for the Himalayan pine, as well as for other woody plants, the hazards of winter injury would be greatly lessened.

HARDINESS, WINTER INJURY AND WINTER PROTECTION

ABSTRACT OF LECTURE GIVEN BY

MR. HENRY TEUSCHER

Dendrologist of the New York Botanical Garden

SATURDAY, MARCH 14, 1936

THE COMPLICATED NATURE of the problem of susceptibility to winter injury was pointed out. In general, conditions arising from whatever source or sources that result in a lowering of the vitality and vigor of the plant make it the more liable to damage by low temperatures.

The nature of the processes worked out in frozen plant tissues was briefly discussed. The formation of ice crystals between the cells making up the plant structures, the mechanical injury that the formation of these crystals may cause to the cells, the concentration of the cell solutions due to the withdrawal of water in the formation of the ice crystals, were indicated as possible causes of direct damage. A great variety of causes tending to increase susceptibility through the lowering of the general level of vigor was indicated, and among these causes several matters of practical handling were pointed out.

1. Late cultivation of the ground, inducing growth so late in the season as to cause the production of tender, unripened wood that cannot resist low temperatures.

2. Late fertilization, or over-fertilization, especially with nitrogenous fertilizers producing a like result.

3. Poor drainage, especially in rich soils, causing a soft, sappy growth that suffers from frost. This tends to produce injury to flower buds, as in Forsythia.

4. Summer drought followed by new growth late in the season. Conifers and other evergreens that have suffered from severe drought during the summer may be beyond hope in the fall, with signs of sudden death appearing the following spring.

5. Mulching with moisture-holding or air-excluding litter may easily lead to the rotting of the flowers of perennials. Alpine plants are especially liable to injury from this cause.

6. Too vigorous summer pruning may lead to late growth and under-ripened wood.

7. The production of a heavy crop of fruit may exhaust the plant and reduce its resistance to cold.

8. Plants may be put in locations giving wrong exposure to sunlight and wind. Bad root drainage may reduce resistance. Planting in "frost holes" where cold air settles may lead to loss.

9. Some plants need protection when young and die when unprotected. If protected for a time they early become cold resistant.

10. Neglect to lift, divide and replant perennials often enough to keep them vigorous and young.

With so many causes of such great variety operating to influence the ability of plants to resist injury from cold, it is clear that the cause of loss in any particular instance may be sought in the innate susceptibility of the plant, such as a tropical plant in a frosty climate, or it may be sought in one or more of the many possible contributing causes arising from the site of planting, application of fertilizers, pruning, fruiting, drought, and from other methods of handling in a great variety of ways.

NORTH AMERICAN PITCHER PLANTS

THE SMITHSONIAN INSTITUTION has just published a work on the North American Pitcherplants, by Mary Vaux Walcott, Edgar T. Wherry and Frank Morton Jones. This is in the form of a quarto-size portfolio, comprising fifteen magnificent colored plates, faithfully copied from Mrs. Walcott's full-size water color paintings of the eleven known species and subspecies, and four interspecies hybrids. Each plate is accompanied by a brief descriptive text, prepared by Dr. Wherry, giving data as to the discovery of the species and remarks as to its noteworthy features.

There is also included a 34-page booklet containing an article entitled "Distribution of the North American Pitcherplants," by Dr. Wherry, together with a most fascinating account of Pitcherplants and their Insect Associates, by Dr. Jones.

The distribution maps are more complete and accurate than any previously published, being based not only on the specimens preserved in herbaria, but also on many weeks of field work. This was made possible by the kind support of the late Mr. Louis Burk, and the specimens obtained in the course of these trips are now, as has already been noted in the Arboretum Bulletin, the property of the Morris Arboretum. Dr. Wherry is Ecologist on the Arboretum staff.

PROTOPLASM

By WILLIAM SEIFRIZ

Professor of Botany, University of Pennsylvania

569 pages, 6 x 9, illustrated, $6.00

THE MYSTERIOUS SUBSTANCE called "protoplasm," Huxley's "physical basis of life," has been intensively studied by many kinds of investigators since its great significance was first recognized.

In a recent book, Professor Seifriz, a member of the Department of Botany in the University of Pennsylvania, has brought together for the first time all of the physical, chemical and biological methods and principles that are known to bear on the properties and behavior of protoplasm.

This book deals broadly with biophysics in its various relations to the branches of science that contribute to the investigation of the biological problems involved. The many chapters making up this book deal with the various technical details that are involved in the study of protoplasm.

THE ARBORETUM AT THE FLOWER SHOW

LAST SPRING the Arboretum accepted the invitation of the Pennsylvania Horticultural Society to make a modest educational exhibit at the annual Flower Show. The invitation was repeated this year, and the Arboretum showed the Burk collection of Bromeliads, purchased and presented to the Arboretum by Mr. Wharton Sinkler. These highly-colored epiphytes are found growing on the large branches of trees in rainy tropical forests. They carry on their entire life history high among the dripping tree tops. Their more familiar and less striking relatives—the so-called "Florida Moss"—that festoons the trees in the South, and the terrestrial Pineapple were also shown.

An educational exhibit of plants representing the chief types seen in the ascending scale of plant development was shown: The water-living *algae* (pond scums, brooksilks, etc.); the fungi, living sometimes as parasites, and often as saprophytes on decaying wood and other vegetable matter; the liverworts, the mosses; the ferns in their young prothallial stage and in the familiar mature stage, the horsetails and other fern relatives, the cycads, the gymnosperms—cone-bearing evergreens—the monocotyledonous flowering plants and the dicotyledons, with their netted-veined leaves, were all represented.

One of the important soil constituents used by green plants is phosphate. A color test, demonstrating the phosphate content of soils, was exhibited, and tests made on soil samples brought in by interested persons.

The recently investigated fungus pest, so fatal to plane trees in the vicinity of Philadelphia, was shown by Dr. L. W. R. Jackson, of the Allegheny Forest Experiment Station, associated with the Botany Department of the University of Pennsylvania. Dr. Jackson's work has revealed the organism causing this disease. (See abstract of his lecture in Arboretum Bulletin No. 2, page 22.)

WINTER LECTURE COURSE

April 11, 1936 **DR. WILLIAM CROCKER**

Injury Caused by Illuminating Gas.

Dr. Crocker is Director of the Boyce Thompson Institute for Plant Research at Yonkers, New York.

This lecture will present the results of much specialized scientific research and will apply these results to practical problems.

ACKNOWLEDGMENTS

The Arboretum has received and acknowledges with thanks the following plants donated by the persons and institutions named:

Allegheny Forest Service

495 Plants of Western Conifers sent from Portland, Oregon

Ambler School of Horticulture

2 Species of Sequoia

Arnold Arboretum

3 Deciduous Trees and many seeds

Edward Auten, Jr., Princeville, Illinois

4 Peony Plants

Mrs. P. P. Calvert, Cheyney, Penna.

6 Plants of Sorbaria sp.

1 English Ivy

Conservation Department of New York

270 Plants of Pinus strobus and Pinus resinosa for research mainly

Hunnewell Estate, Wellesley, Mass.

Cuttings of 14 Taxus varieties (forms)

Outdoor Arts Company, Flourtown, Pa.

Many conifer cuttings—12 varieties

Oxford Paper Company, Rumford, Me.

60 Hardwood Cuttings of 10 varieties of commercial paper poplars.

Pennsylvania State College

12 Seedlings of Planera aquatica

Mrs. Samuel P. Rotan, Chestnut Hill, Phila.

1 Cedrus deodara plant

Mr. Edward Rosenbluth, Wallingford, Pa.

67 Plants of Iris (six varieties)

Mr. Maurice Bower Saul, Rose Valley, Moylan, Penna.

Coniferous Evergreens

Mrs. Charles H. Stout, Short Hills, N. J.

1 Chinese species of Salix

U. S. Department of Agriculture, Bureau of Plant Industry, Washington, D. C.

253 Deciduous and evergreen trees and shrubs and tender greenhouse plants

Mr. John C. Wister, Germantown, Phila., Pa.

60 Varieties of Lilac Scions, 35 species

The Arboretum has received valuable plants and cuttings by exchange with the following persons and institutions:

Ambler Nurseries, Ambler, Pa.

29 Evregreen and deciduous shrubs, some perennials

Fairmount Park Commission

8 Seedlings of deciduous trees

Koster's Nurseries, Bridgeton, N. J.

220 Conifers and 40 Rhododendron Hybrids

Masonic Home, Elizabethtown, Pa.

57 Evergreen and deciduous plants.

New York Botanical Garden

120 Evergreen and deciduous plants.

Hardwood cuttings from which 750 plants were grown

Mr. Maurice Bower Saul, Rose Valley, Moylan, Penna.

69 Evergreen and deciduous trees and shrubs

Swarthmore Arboretum, Swarthmore, Pa.

89 Deciduous and evergreen trees and shrubs and some seeds

Towson Nurseries, Towson, Maryland.

78 Evergreen deciduous trees and shrubs, including grafted *Pinus excelsa zebrina*